

INTERIM

SOIL CONSERVATION SERVICE

WEST VIRGINIA

ENGINEERING STANDARD

FILTER STRIP (Acre)

Definition

A strip or area of vegetation for removing sediment, organic matter, and other pollutants from runoff and waste water.

Scope

This standard establishes requirements for design, operation, and maintenance of vegetated filters. It does not apply to field borders (386).

Purpose

To remove sediment and other pollutants from runoff or wastewater by filtration, deposition, infiltration, absorption, adsorption, decomposition, and volatilization, thereby reducing pollution and protecting the environment.

Conditions Where Practice Applies

This practice applies on cropland at the lower edge of fields or above conservation practices such as terraces and diversions, or on fields adjacent to streams, ponds, and lakes. It also applies when a vegetated filter is required as part of a waste management system, or as a part of a forestry operation to reduce sediment entering waterways.

Federal, State, and Local Laws

All federal, state, and local laws, rules, and regulations governing waste management, pollution abatement, health, and safety shall be adhered to. The owner or operator shall be responsible for securing all required permits or approvals and for performing in accordance with such laws and regulations. SCS employees are not to assume responsibility for procuring these permits, rights, or approvals or for enforcing laws and regulations. They may provide the landowner or operator with technical information needed to obtain the required rights, or approvals to construct, operate and maintain the practice.

When vegetated filter strips are used as part of an animal waste management system, permits will be required from the West Virginia Department of Health. If a discharge is planned, a permit will be required from the West Virginia Department of Natural Resources.

Planning Considerations

Type and quantity of pollution must be determined. Slopes, soils, vegetative species, construction timing, need for irrigation, method of operation and maintenance must be considered. If the vegetated filter has outlet flow, it must be nonerosive.

When vegetated filters are used as part of an animal waste management system, additional considerations are:

1. No outlet flow shall be planned for infiltration channels that are part of a concentrated waste treatment system. This applies to milk parlor wastewater overflow from lagoons, and drainage from waste storage structures.
2. Soil drainage must be adequate to allow complete infiltration.
3. Temporary storage shall be utilized to avoid loading the infiltration channel more than once in 3 days, or
4. Alternate infiltration channels to allow resting of the soil and vegetation.
5. Winter conditions will drastically reduce vegetated filter efficiency. The design must compensate for this reduced capacity by providing additional filter area or alternate channels during winter.
6. Roof water or unpolluted surface runoff shall be excluded from the vegetated filter.
7. Flat slopes give best results. Grades less than 5 percent are desirable.
8. Level lip weirs, perforated pipe, sprinklers, or other similar facilities that will ensure even distribution of flow in the vegetated filter.

Design Criteria

General

A soils report prepared by a qualified person shall be part of the documentation attesting to the feasibility of the vegetated filter system.

Grass species shall be such that the grass stems will remain upright during any design flow. For flow depths of .1 ft or less use $n = 0.04$. Where flow will be up to .5 ft, use $n = 0.07$.

Vegetation and Protection

Seedbed preparation and seeding shall be in accordance with the standard for Critical Area Planting (342) and/or Pasture and Hayland Planting (512). The type of vegetation shall be specified on the plans.

The Conservation Reserve Program (CRP) Filter Strip Practice allows woody plant establishment. After the CRP filter strip (Filter Border) area (66-99 feet in width) is protected against erosion through the planting of grasses and legumes, woody plants can be introduced. Planting of woody species shall be in accordance with the provisions outlined in the Field Border Standard (386).

Fences will be installed around filter strips where it is necessary to prevent damage caused by livestock. Fences will be designed and built in conformance with WV Standards 472, Livestock Exclusion or 382, Fencing.

Filter Border

An area of vegetation around cropland or pastureland; adjacent to ponds, streams, and lakes; or above conservation practices that removes sediment, organic matter, or other pollutants from water.

Filter borders around cropland and pastureland, adjacent to streams, ponds, or lakes, or above conservation practices shall have a flow length of at least 9.9 ft for slopes less than 1 percent. Flow length shall increase proportionally up to a minimum of 33 ft for 30 percent slopes.

Filter Channel

A vegetated channel below feedlots, barnyards, or settling facilities that removes sediment, organic matter, or other pollutants from water flowing through the channel.

A filter channel may be a relatively uniform grass area or a constructed grassed channel. Area, or minimum channel dimensions, shall be based on the peak rate of runoff for a 2-year, 24-hour rainfall on the feedlot, barnyard, or contributing area.

Filter channels below barnyards and feedlots shall be protected from overloading by the installation of a settling basin or low velocity channel. The settling basin or low velocity channel shall trap solids before the drainage enters the filter channel. Settling basins or low velocity channels are recommended to protect all filter channels, but are required when the feeding operation will have 100 or more 1000 lb animal units.

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Settling basins shall have sufficient capacity to store the runoff from 15 minutes duration at the peak inflow rate resulting from a 2-year, 24-hour rainfall. Outflow shall be neglected for this storage computation. Additional storage capacity shall be provided based on the frequency of cleaning the basin. Additional capacity in the amount of 0.5 in of runoff from the drainage area shall be provided if the basin is cleaned after every runoff event. If only annual cleaning is planned, the additional capacity required is 6 in of runoff from the drainage area.

A low velocity channel shall be a minimum of 82 ft long. It shall be designed for a flow depth of 6 in or less when passing the peak flow from a 2-year, 24-hour rainfall at a velocity of 0.5 fps, or less. The channel shall have provision for cleaning out the solids which will accumulate.

Filter channels below settling basins and low velocity channels shall provide at least 30 minutes of flow-through time at a depth of 0.5 ft or less.

Infiltration Channel

A vegetated channel receiving drainage from milking parlors, food processing plant, and animal waste treatment or storage facilities. No discharge is allowed from an infiltration channel.

Infiltration channels receive drainage from milking parlors, animal waste storage facilities, food processing plants, or overflow from waste treatment lagoons.

Infiltration channels shall be installed on natural or constructed slopes no steeper than 6 percent. Minimum flow length is 100 ft. Between 2 and 6 percent slope, the flow length shall proportionately increase to 300 ft.

Weekly wastewater application rates should not exceed 6 in over the infiltration area. Highly concentrated wastes, such as drainage from a waste storage facility, should be limited to weekly rates less than 2 in over the filter area. Alternating infiltration channels every other day is highly recommended.

Application times should not exceed 6 hours. The application time should be reduced to 2 hours for very concentrated waste. This will require some type of controlled outlet temporary storage. In no case should the channel be continuously trickle-loaded.

Infiltration channels should be rested at least 2 days per week.

Infiltration channels shall have no discharge.

Forestland Filter Channel

A vegetated channel used to collect drainage and reduce sediment delivery into forest drainageways.

These criteria are for filter channels used as part of a forestry operation to reduce sediment delivery into forest drainageways. The lengths in the following table should be considered minimums:

<u>Length</u>	<u>Land Slope</u>
25 ft	up to 1 percent
65 ft	1 to 30 percent
150 ft	30 to 70 percent

Operation and Maintenance

An operation and maintenance plan shall be prepared with the landowner. The operation and maintenance plan should consider the following items:

1. Periodic inspections and repair of rills and low areas that would prevent sheet flow.
2. Fencing to prevent free access to the strip or channel.
3. Vegetation must be maintained in vigorous growth.
 - a. Mow when needed.
 - b. Irrigate if needed.
 - c. Reseed bare areas.
 - d. Remove deposits from channels.
 - e. Rest the strip to maintain aerobic soil condition.
4. Timely cleanout of settling basins.
5. Schedule for release of drainage from temporary storage.

Plans and Specifications

Plans and specifications for filter strips shall be in accordance with this standard and shall describe the requirements for applying the practice to achieve the intended purpose.

Specifications will be prepared using NEH-20 Specifications, WV 700 Series Specifications or the attached specification may be used for filter strips which do not require installation of settling basins, pipes, or other structures.

Drawings will include:

1. Elevations, dimensions and grades necessary to construct the filter strip and associated structures.
2. A materials list with appropriate reference material specifications (ASTM, etc.).
3. Seeding and fencing requirements.

CONSTRUCTION SPECIFICATION

West Virginia

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All trees, stumps, roots, rocks, brush, and similar materials that can interfere with installing the vegetated filter shall be removed. The materials shall be disposed of in a manner that is consistent with the surrounding environment and with proper functioning of the vegetated filter.

When required, the filter shall be shaped to the grade and dimensions shown on the plan or as staked in the field. Topsoil shall be stockpiled and spread to the required grade and thickness. Excess spoil shall be disposed of in areas where it does not interfere with the required flow characteristics of the vegetated filter.

Construction operations shall be carried out in such a manner and sequence that erosion and air and water pollution will be minimized and held within legal limits. All disturbed areas will be graded smooth and blend with the surrounding ground, prior to seeding operations.

A protective cover of vegetation shall be established on all exposed surfaces of the filter strip and spoil areas where soil and climatic conditions permit. Lime and fertilizer will be spread at the rate shown on the drawings and will be disked into the soil to a depth of 4 inches to prepare a seedbed. Seed and mulch will be spread at the rate shown on the drawings. Where soil or climatic conditions preclude the use of vegetation and protection is needed, nonvegetative means such as mulches or gravel may be used. In some cases, temporary vegetation may be used until conditions are right for establishment of permanent vegetation. When required, the filter strip shall be fenced, as shown on the drawings, to protect the vegetation.

Planning considerations for water quantity and quality***Quantity***

1. Effects on the water budget, especially on volumes and rates of runoff, infiltration, evapotranspiration, deep percolation, and ground water recharge.
2. Effects caused by seasonal weather variations.
3. Effects of the filter strip vegetation on soil moisture.
4. Effects on the volume of soil water caused by changes in plant growth and transpiration.
5. Effects of vegetation on water retention within the filter strip.

Quality

1. Effects on the nutrient budget within the filter strip as related to removal, residence, or accumulation of nutrients. Nutrient budgets should account for effects of growing and decaying vegetation.
2. Filtering effects of vegetation on movement of sediment, pathogens, organic loads, and dissolved and sediment-attached substances.
3. Effects of the filter strip vegetation's uptake of nutrients on surface and ground water.
4. Effects of the timing of the vegetation's management, including clipping, harvesting, removal and re-establishment on the nutrient balance within the filter strip.
5. Effects on the visual quality of onsite and downstream water resources.